

Isoreticular Crystals

Materials Design & Discovery Group

M. Eddaoudi, J. Kim, N. Rosi,

D. Vodak, J. Wachter, M. O'Keeffe, O.M. Yaghi

(University of Michigan and Arizona State University)

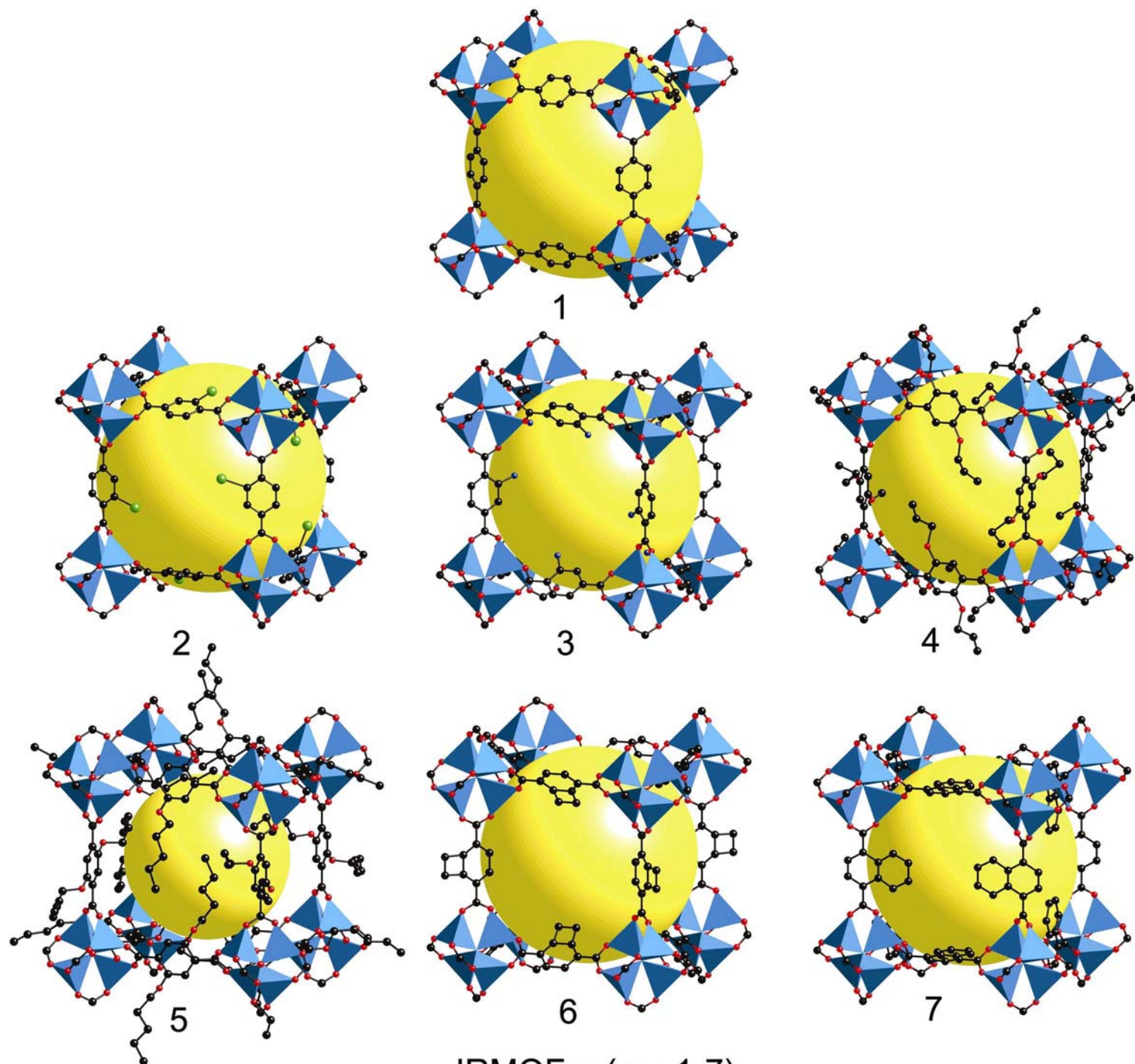
The Challenge:

Systematically alter the chemical composition, functionality, and molecular dimensions of solid state materials without changing their underlying framework topology.

Approach:

Apply our knowledge of the synthesis and design principles of metal-organic frameworks to generate an isoreticular series of frameworks (having the same framework topology) whose functionalities and dimensions are systematically controlled.

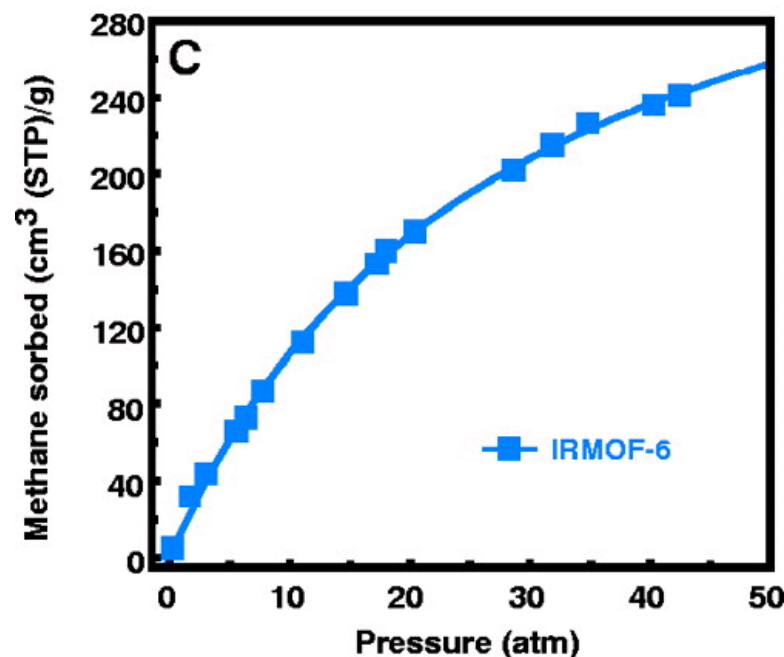
IRMOFs—Pore Functionalization



IRMOF-n ($n = 1-7$)

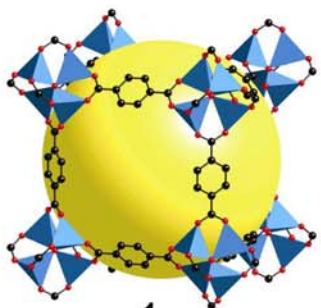
Highest Methane Storage Capacity

IRMOF-6 had an uptake of 240 cm³ of methane at standard temperature and pressure (STP)/g [155 cm³ (STP)/cm³] at 298 K and 36 atm. On the basis of volume for volume (v/v), the amount of methane sorbed by IRMOF-6 at 36 atm (which is regarded as a safe and cost-effective pressure limit) represents 70% of the amount stored in compressed methane cylinders in laboratories where much higher, unsafe levels of pressure (205 atm) are used. The methane uptake properties of IRMOF-6 exceed the required DOE criteria for automobile fueling.

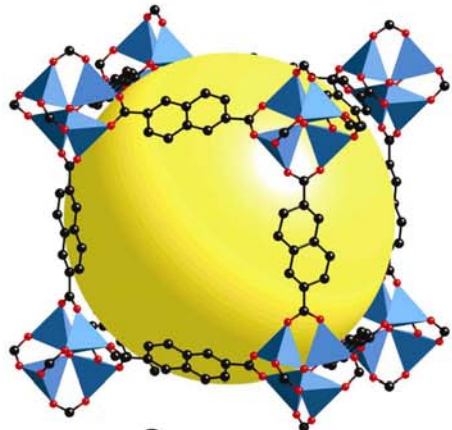


IRMOFs—Systematic Variation of Pore Dimension

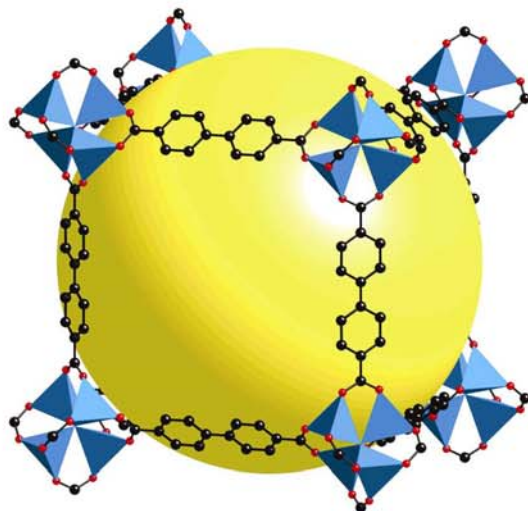
IRMOF-n (n=8-16)



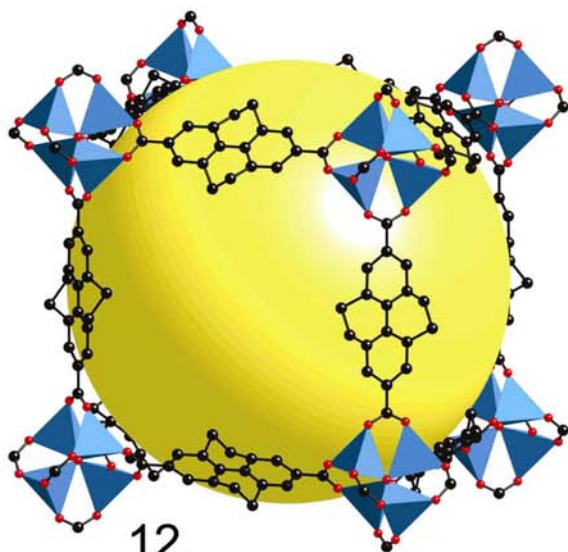
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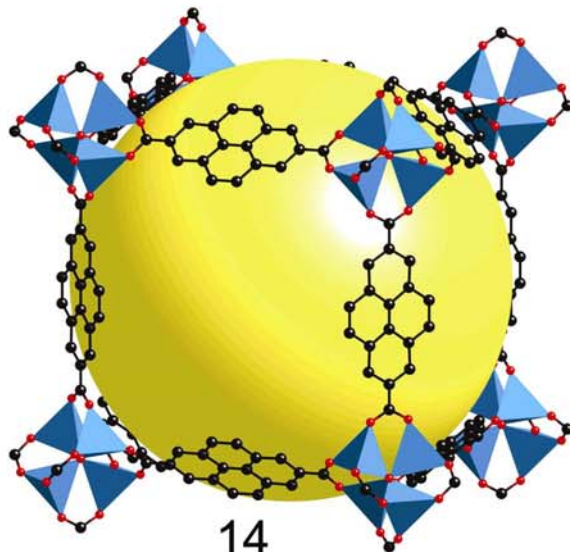
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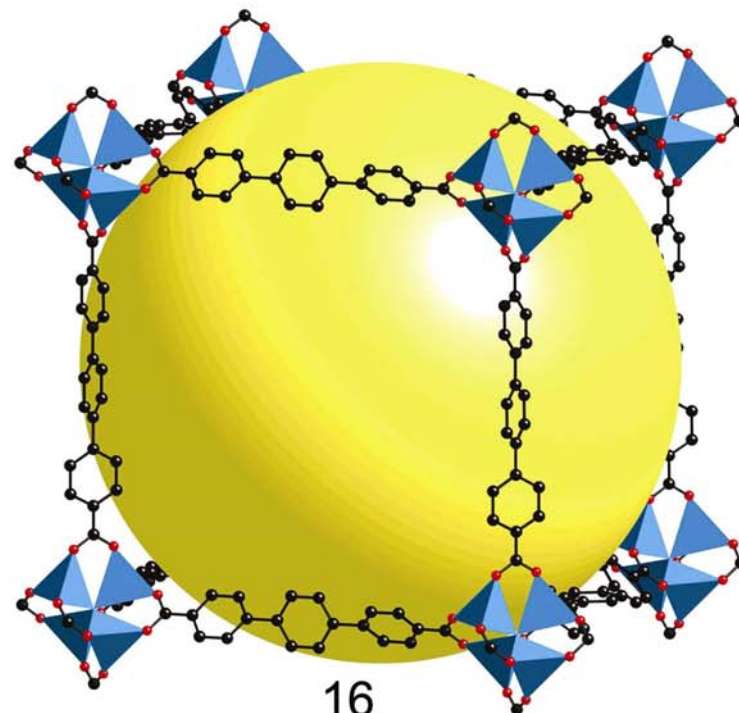
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